THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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THE FAURE SECONDARY BATTERY.

THE exhibition of a number of the Faure cells at the scientific *soirée*, given recently at King's College, London, attracted a good deal of attention, as it was the first practical exemplification in this country of the powers of this most recent electrical novelty. As regards the possibility of using the apparatus for lighting purposes, the exhibition was a success; 20 of Swan's incandescence lamps were kept lighted from 44 of the Faure cells.

In estimating the practical utility of the invention, a great number of points require to be considered, and care should be taken to avoid drawing an unfair conclusion from the results of experiments made under unsuitable conditions. We hear that 160 of the Faure cells, costing £800, and weighing a ton and a half, were recently tried for driving a tram-car in the streets of Paris; as a commercial question this result cannot be regarded otherwise than as unsatisfactory, but the only conclusion that should be drawn is, that for the particular purpose the apparatus is unsuitable. Stored energy, in the form of compressed air, which has again and again been proved to be successful for locomotive purposes, practically leaves stored electricity nowhere—that is, in the form in which it at present exists. It must be recollected, however, that stored energy in the form of compressed air cannot give out light directly, as stored electricity can, and that, therefore, the latter in this case has the advantage.

The great difficulties to be contended with before the storage of electricity can be pronounced to be a practical success are those of mass, time, and durability; the latter in the case of the Faure battery has yet to be proved to be sufficiently great to enable it to affect as little as possible the general working expenses. The element of time is a very important one, and unless it can be brought within reasonable bounds, it may prove a very serious obstacle to the success of the Faure system. It is the one element of which but little information has yet been received, and yet it is of the highest importance. If, as appears to be the case, as long a time is required to charge the cells as is required to discharge them, the electricity generated by the dynamo machine might almost just as well, in the majority of cases, be delivered direct from the machine as from the battery. In cases where the Faure battery would be really useful—that is, where it would be inconvenient to have machinery erected, or to have wires extended to convey the power—then the element of mass becomes a serious obstacle; great weight and large bulk compared with the amount of energy stored, the secondary cells certainly possess, and at present there does not seem much prospect of these being much reduced, and nothing less than a wholesale reduction in these respects can, we think, make the arrangement a success. One horse-power per hour contained in a weight of 75 kilogrammes is not a large amount, and yet this quantity, which is claimed for the Faure cells, is stated, and has been proved by experiment, to be very much in excess of the truth. No doubt the economical storage of electricity will be effected sooner or later, and when it is thus effected it will mark an era in mechanical science, but as yet it is very far from being successfully carried out.

RAILWAY SIGNAL REPEATERS AND LIGHT INDICATORS.

By E. T. ROLLS, A.S.T.E.,
Superintendent Western District, L. & S. W. Railway.

IT will be obvious to all acquainted with railway working that, no matter how perfect is the electric block apparatus for signalling trains, the safety of those trains must ultimately depend upon the electric signalling being accurately translated to the engine drivers by a correct signal out on the line. It being, therefore, of vital importance that the signalman should show a correct signal, it becomes a necessity that he should have means of assuring himself of the position of his signals, when from a multiplicity of causes they are out of sight from the cabin.

Mechanical methods of various kinds have been employed for this purpose, but they have, as a rule, proved cumbrous and made way for electrical apparatus.

The subject has had my attention for some years, and the means I have devised for meeting the requirement having stood the test of practice, a description of them may be interesting to some of the readers of this Journal.

SIGNAL REPEATERS.

From the context it will be plain that these, to be efficient, must be free from liability to error by the effects of line faults—earth or disconnection, and a great number being required upon a railway, they must be cheap.

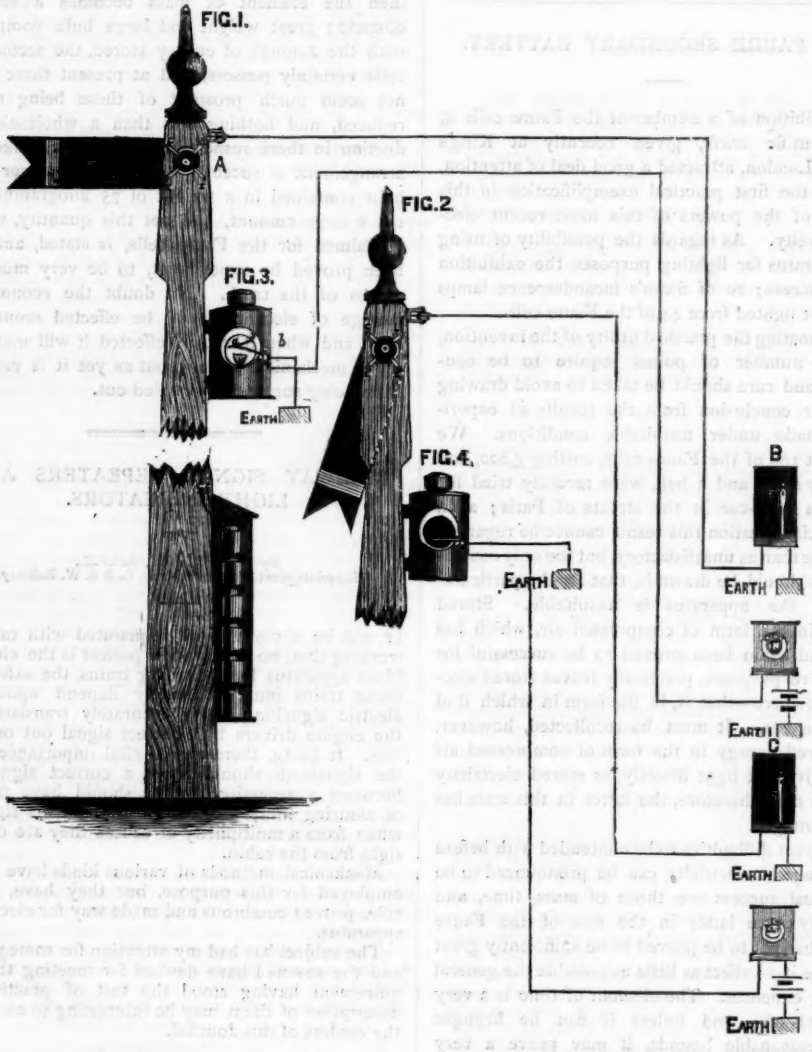
The first condition is obtained by arranging the

battery at the signal post. Earth or disconnection then intervening between there and the cabin can produce no false signal upon the repeater, but in case of either fault happening, a neutral (drooping) position will be shown on the instrument, unalterable by the signal lever, and the signalman will learn thereby that the apparatus requires attention.

The second condition, economy of material, is attained by so arranging the connections that a single battery and one wire suffices for the three positions of the repeater—"on," "neutral," "off"—while a thorough rubbing contact is always insured.

The arrangement is shown in figs. 1 and 2.

The contact maker, A, is firmly fixed on the axis of the semaphore signal, and moves with it. The four rubbing contact springs, L, C, Z, E, are stationary, and the whole is protected by a cover. With the semaphore arm "on," fig. 1, a copper current is sent to line, with the arm "off," fig. 2, a zinc current is sent. These currents produce corresponding "on" and "off" signals upon the electric repeater, B, C. Intermediate (improper) positions of the semaphore signal by bringing the rubbing springs upon the insulated parts of A, disconnect



the battery, the repeater drops to a neutral position, and the signalman seeing this, pulls or throws his lever over once more, and, if necessary, regulates the signal wire until a correct signal is shown.

The repeater instrument placed in the cabin, B, C, may be of any outward pattern, generally a miniature of the signal outside (and semaphores are now most common); it must of necessity contain inside an electro-magnet, magnetised needle, or both.

An ingenious instrument of the needle form has been introduced upon the London and South Western Railway by Mr. C. Goldstone, the Company's Chief Superintendent.

In this the needle is so balanced that with one current the small semaphore borne upon its axis goes to "on," with the reverse current it goes to "off," and with no current it falls diagonally.

The selection of the battery for this particular work is of importance. To be economical in maintenance it must be capable of supplying a constant current for considerable time without attention, the more so as it is at a distance from the station. Further, its solutions must have a low freezing point, or they will become solid and inert in severe winter weather.

These conditions I find fulfilled in the "Howell" cell.* Its e. m. f. is very high, about 2 volts, so that few cells are necessary, and compactness is gained. Its solutions only congeal at about 5° Fah., a temperature not likely to be reached inside its case, and it will last on constant current through the repeated resistance for ten or twelve weeks, and sometimes longer.

LIGHT REPEATERS.

After various trials in this direction I have found the form shown in fig. 3 the most successful of my attempts. It is very simple, cheap, and has the peculiarity of providing a superabundance of direct movement for making and breaking contact without the intervention of any auxiliary aids for multiplying the actual lineal expansion of the metals employed, and this peculiarity insures a strong rubbing contact, desirable in all cases, but above all where the contact points are subjected to heat. The arrangement consists of two bimetal straps (brass and steel) joined at one extremity, *a*, fig. 3.

The lower one next to the burner has its steel facing downwards. The upper one has its steel upwards.

The heat of the lamp flame produces a curvature of the compound metal straps, causing them to fly apart at their free end. And this movement is further greatly increased by the tilting of the upper strap as it follows the motion imparted to it by its attachment to the lower.

So considerable, indeed, is this motion with a moderate amount of heat that a flexible tongue, *c*, set back on the upper strap is necessary to relieve the strain upon cooling, while at the same time it produces the rubbing contact alluded to, and affords means of regulating the time of make and break to such nicety that the signalman may be warned of an insufficient light requiring trimming, or gas, even without its total extinction.

The apparatus in the cabin for calling the signalman's attention consists of the battery and a trembling bell with indicator, showing "light in" and "light out," the former by gravity when the circuit is broken at the lamp (fig. 3), the latter by the current which simultaneously rings the bell when, on cooling, the circuit is completed by contact being made with earth at the lamp (fig. 4).

During the day the battery is disconnected and only brought into circuit by inserting a peg at lighting-up time, and the signalman can always test the apparatus by inserting this peg before the metal straps break contact.

* See TELEGRAPHIC JOURNAL, December 1st, 1879, page 388.

ELECTRIC INDUCTION BY STRESS.

By S. W. ROBINSON, Professor of Physics and Mechanical Engineering, Ohio State University.

JOULE has shown that when a bar of iron is magnetised by means of a helix and electric current the bar is elongated appreciably. These elongations have been measured by Prof. E. A. Dolbear.

While undertaking some experiments in December, 1878, it occurred to me that the inverse of this ought to be true, namely, the forced elongation of a bar of iron, surrounded by a helix, would give cause for an electric current through the helix and connections. A series of experiments followed which completely verified the supposition, a recital of which may be of interest. The publication of them was deferred from time to time in the hope of more varied experiments, and in the possible discovery of like experiments by others.

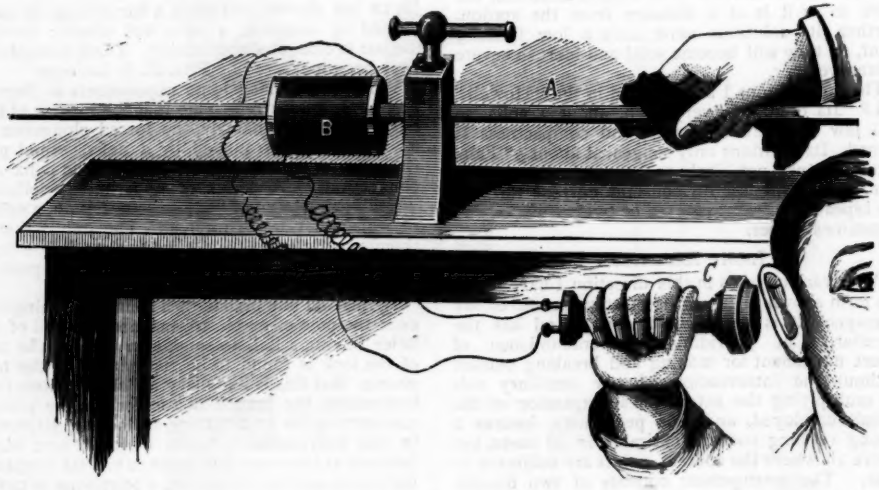
By placing one branch of a sounding tuning-fork near the pole of an electro-magnet, the coil of the latter having a Bell telephone in circuit, the tone of the fork is found to be reproduced in the telephone. But this is like using a Bell telephone for a transmitter, the branch of the fork in the present case serving for an armature, as does the diaphragm in that instrument. Again, when an iron bar is fastened at its centre and made to vibrate longitudinally near an electro-magnet, a telephone in circuit will speak, and for the same reasons as before. Remove the core of the magnet and the sound is still heard at the telephone, and it is not necessary that the bar be a magnet. Bars of iron were selected that possessed a minimum amount of magnetism, in fact an almost inappreciable magnetism, and still a loud sound was emitted by the telephone.

The helix used had no iron about it when the core was removed, and the opening for the core was large enough to encompass the bar without touching it. The bars used were several times the length of the helix.

At first it was supposed that the *motion* of the iron longitudinally was chiefly concerned in the production of sound. On this supposition the sound would diminish as the helix was moved toward the middle of the bar where it was firmly secured in a clamp for longitudinal vibration. But instead of this, the intensity was increased, and to such an extent that the auditor at the telephone in a distant room could positively say whether the

coil was at the end or at the middle of the longitudinally vibrating bar. This made it clear that the sounds observed were not to be explained altogether on the ground of vibratory motion of the particles of the bar, because the motion of the bar at its middle is *nil* when clamped at this point and vibrating longitudinally at its fundamental, while at the ends we have a maximum degree of vibratory motion. But at the middle of a bar thus conditioned we have a node, and the strains are here known to be those of extension and compression and at a maximum for the bar, while at the ends, the alternating strains are *nil;* that is, where the motion is greatest the strains are least, and *vice versa*. It seems, therefore, certain that at the middle the sound is chiefly due to the vibratory stresses, while at the ends it is almost entirely due to motion.

The engraving shows the apparatus. Rods were used which were from one-quarter to one-half inch



in diameter and three feet long. The coil was about three inches long, and so connected with the free circuit wires that it could readily be moved along the rod. As the clamp prevented placing the coil exactly at the middle of the bar, the latter, to test this point, was taken out and suspended by two filaments so light as not to interfere with the vibration, and the bar made to vibrate longitudinally by striking on the end with a mallet. The coil was placed directly at the middle and also shifted to right and left, but the sound was still loudest at the middle. Sounds produced by the transverse vibrations, now accidentally occurring and mixing with those due to the longitudinal vibrations, were heard, but were readily distinguished by the pitch of tone. These were separated from the above consideration of longitudinal vibrations.

To further test the matter of electric induction by stress, a rod was passed through the coil, and the rod put under tension in a testing machine. A galvanometer now placed in the circuit became very active as the strain was put on. The bar was an ordinary three-eighths rod of commercial bar iron. It was at once found to be permanently stretching, and the galvanometer needle was all the while flying about as the extension continued. When the bar was removed, it was found to be strongly magnetic, much more so than it could have been when put in. It was also heated. It therefore seemed difficult to determine whether the observed currents of electric induction were due to strain, stretch, magnetism, motion, or heat, in part or together.

A piece of white chilled cast iron was then tested to 42,000 lb. compression, and found to resist the full power of the machine without crushing or set. The coil was then placed around the rod, and the test for stress-electric induction applied. Under compressive strains the needle gave unmistakable evidence of electric currents, though they were much feebler than in the previous case of soft iron.

Experiments on steel bars, not magnetised, gave appreciably the same effects as iron bars. Magnetised steel was not tried, but it is presumed that at the end of the bar magnet vibrating longitudinally the sounds would be intensified, while at the middle of the bar, normally magnetised, the sounds probably would not materially differ from those obtained from non-magnetic bars.

A few other metals were tried, copper and brass particularly, but no sounds were heard from them. These experiments, though far from being complete and exhaustive of the subject, warrant us in the following conclusions, namely :—

1st. That the fact of Joule, of the distortion of bars of iron by magnetisation with electric currents, is operative in the inverse order, namely, distortion of bars by mechanical force induces electric currents in surrounding coils.

2nd. Most other metals than iron or steel give but feeble if any observable results of stress-electric induction.—*Scientific American.*

Reviews.

Electrotyping, a Practical Manual. By J. W. URQUHART, C.E. London: Crosby Lockwood & Co.

THE art of electrotyping, as distinct from electroplating, has now become an important industry, and, like other branches of manufacturing art, it requires a manual to explain to the rising generation what processes are involved in carrying on the work of the electrotyper. The book before us is certainly a good attempt to supply a real want. Following the usual fashion, Mr. Urquhart has attempted in the introduction to give some explanation of the theory of the electric battery, the meaning of the various electrical units, &c. Such matter is, we think, of but very little, if any, practical value to those who are likely to study the book. Those who wish to get a clear insight into the whole of the principles involved will certainly not be much enlightened by descriptions which, to be of real value, cannot but be lengthy. But although much of the matter in the introduction might have been left out without injury to the book, still there is a good deal which could be read with great advantage, and which is an indication that the author is quite at home on the subject he treats of.

In the chapter on sources of electricity Mr. Urquhart gives very many most useful hints with reference to the construction of batteries, and he points out with reference to the battery which is a very favourite one with amateurs, namely, the Smee, that its usual construction is anything but a good one. Philosophical instrument makers, it must be admitted, are not, as a rule, very happy in the designs of the instruments and batteries they supply, as amateurs often find to their cost.

It seems somewhat curious that the Smee, which is by no means a constant battery, should have proved to be such a favourite one with electrotypers. The Daniell, it seems, has not found so much favour as its constant properties would appear to warrant. In speaking of the Daniell battery many thoroughly practical and useful hints are given with reference to the proper arrangement and maintenance of the cells. It is wonderful what a difference a little attention to such hints will make in the working of a battery.

Speaking of the bending of battery zincs, Mr. Urquhart states that if the latter be heated by being plunged into boiling water they may be easily curved and bent to the required shapes. This is certainly a very useful fact to know, and one which may save a great deal of trouble.

The thermo-electric battery seems eminently suitable for electrotyping and electro-plating purposes. Nearly all those hitherto tried have, however, failed in their action eventually. The principal cause of this has, we believe, been due to the fact that the piles have been subjected too often to alternations of heat and cold, which has "racked" the junctions of the dissimilar metals and caused eventual disconnection faults. If the piles were kept continually warm they would probably last for an indefinite period, and would prove very economical, in spite of the comparatively large consumption of gas which would be required to keep up the continual heat. The thermopile is certainly *par excellence* a *clean* source of electricity.

The "safety current interrupter" invented by Mr. Urquhart, and used for the purpose of preventing the reversal of the current which might take place when the latter is generated by a dynamo machine, is certainly as simple and as effective an arrangement as could be desired.

The chapters of the book on "Solutions," "Depositing and Moulding Apparatus," "Preparation of the Work," &c., are written in a very practical manner, and give such details as are very essential to insure success. Altogether we must confess that the book is an excellent addition to the growing list of electrical works, and is by no means a merely ornamental volume. It is one which every one who wishes to know about electro-plating should purchase.

Electricity. By FLEEMING JENKIN, F.R.S. London: Society for Promoting Christian Knowledge.

PROFESSOR JENKIN is so well known in the electrical scientific world that any book from his pen must command popularity. The task of writing the treatise must have been a somewhat difficult one, considering that there are but 120 small pages of matter, and that the subject treated of is of such vast extension. Altogether the information given has been judiciously chosen, although the work by itself is hardly one which could with advantage be put into the hands of any one who commences to study the subject for the first time.

Book Received.

A Handbook of Electrical Testing. By H. R. KEMPE. New edition, revised and enlarged. E. and F. N. Spon, London.

Notes.

ON THE INFLUENCE OF TEMPERATURE UPON SELENIUM TELEPHONIC RECEIVERS.—M. E. Mercadier concludes from experiments undertaken that radiophonic receivers, constructed of selenium, tend more or less rapidly to a state of stability relatively to the effects of temperature. At ordinary temperatures, and even up to 100° C., the resistance of these receivers varies inversely as the temperature between 5° or 6° to 35°, these variations may be considered approximately as mutually proportionate.

ON THE THERMIC LAWS OF THE EXCITING SPARK OF CONDENSERS.—By M. E. Villari.—The author terms the "exciting spark" of the discharge of a condenser that which is produced against the exciter, whilst he names that which is formed in an interruption the "conjunctive spark." The properties of the latter he has explained elsewhere. To study the heat of the exciting spark he has constructed an "exciter thermometer," which consists of an exciter inclosed in a glass globe. By means of two tubulures this globe

was supported by two bands of ebonite, upon which it could turn around a horizontal axis and close the circuit of a battery to which it was connected at the moment of the discharge, the spark bursting in the balloon. The heat developed was measured by the displacement of an indicator of glycerine and water contained in a vertical tube of glass attached to the globe. On experimenting with this apparatus for different charges communicated to one and the same battery, he has found as a mean result, and within the limits of his researches, that the heat developed by the exciting spark alone is approximately proportional to the square of the charges. This law is not general, for the experiments are complicated by various phenomena. The glass of the jars does not always retain electric charges well, and jars are met with which cannot be charged. It is necessary to select jars and to coat them with a good lac varnish.

Further, he has found when experimenting with high potentials that energetic interior discharges are produced in the jars, and there is a development of heat to the detriment of that which accompanies the exterior exciting spark.

He has also remodelled his thermometer, and on repeating his experiments has obtained concordant results which may be summed up as follows:—

1. The heat of the exciting spark increases more rapidly than the third power of the charges for a small potential.

2. For a medium potential it increases as the squares of the charges.

3. For a very high potential it increases as the charges.

It is probable that account should be taken of the influence of internal discharges. They are very small for small potentials, but increase very rapidly as the potential is augmented.

He has also studied how the heat produced by the spark varies with the quantity of electricity, the potential remaining constant. He finds that the heat of the exciting spark alone grows a little less rapidly than the charge when the potential is constant. More exactly when the charge increases from 1 to 2, the heat produced rises from 1 to 1·77.

He has also caused the potential of a constant charge to vary, accumulating it in a variable number of bottles, and has proved that the heat of the exciting spark alone increases:

1. More rapidly than the potentials, if they are small.

2. As the potentials, if they are medium.

3. Much less than the potentials, or even decreases if the latter are very high. These different effects are also affected by internal discharges. In case of small potentials, he finds that on increasing the potential from 1 to 2 (12 of the electrometric charges being at first distributed in 24, and then in 12 equal jars), the heat of the spark increases in the ratio of 1 to 3·81.

To sum up, it may be said that for small potentials, when in a condenser, the charge and the potential are made to increase at the same time and in the same proportions (as occurs when the electric mass is augmented in one and the same battery), in the ratio of 1 to 2, the heat of the spark should increase, according to the foregoing results, in the proportion of 1 : 1·77 × 3·81, that is 1 : 6·74. If we know the heat developed by the spark of charge 1, we may determine, in this indirect manner, and the heat determined by a charge 2 accumulated in the same condenser.

The author's experiments show a complete agreement between the quantity of heat, as determined by direct measurements and as calculated by the indirect method.

The law of the surfaces of condensers is evidently intimately connected with that of the potentials; thus the same three cases which have been indicated for the laws of potentials will be distinguished for surfaces.

From the foregoing it results that for a determined potential of a given charge the heat developed is divided between the internal spark and the external "exciting spark" in such a manner that in the latter it augments proportionally to the squares of the charges, and in an inverse ratio to the surface of the condensers.

These laws, which may be named the limiting laws of the spark, are the same as those which apply to metallic wires. It may thus be said that:

The heat developed by the spark is proportional to the quantity of electricity multiplied by the electric density, or it is proportional to the quantity of electricity for the fall of the potential.

A part of the spark may be replaced by a metallic wire, and *vice versa*. It is necessary that the sum of all the other effects produced by the spark should follow the same laws.

There is, however, an essential difference between the spark and the wires, as far as thermic phenomena are concerned. The spark increases both in length and section in proportion as the charges and the potentials increase. It may, therefore, be regarded as a variable conductor, in which the heat may be a function of the number of the component gaseous molecules, and perhaps of their temperature.

In metallic wires, which may be regarded as fixed conductors, the thermic power is an exclusive function of the temperature.—*Comptes Rendus.*

M. GASTON PLANTÉ writes to us to say that it is not his intention to establish works for the manufacture of his secondary couples, as was stated in our last issue; these couples have been constructed for some time past in the workshops of M. Breguet. It is also a mistake to suppose, as has been stated, that the modification of the Planté couples, made by M. Faure, cannot be charged by dynamo-electric machines, whilst the ordinary form can. M. Planté says simply that magneto-electric machines do not answer as well as batteries for the charging of his couples, either prepared or unprepared, as, in consequence of the inequalities of the electro-motive force of the current given by the machines, a portion of the charge taken can discharge itself proportionally in the circuit of the machine when the electro-motive force of the latter falls below a certain point. M. Planté thinks, nevertheless, that it would be more advantageous to store up the electricity of machines than of batteries, now that voltaic electricity is produced by mechanical work in greater quantity, and with greater economy, than by chemical action. (For a full illustrated description of the Planté battery see TELEGRAPHIC JOURNAL, Dec. 1st, 1875.)

IN the House of Commons on the 8th inst. the Attorney-General, in answer to a question put by Sir H. Tyler as to the responsibility of local authorities for the safety of the public as regarded casualties from the fracture of the telegraph wires stretched over the public thoroughfares, said that by the Act of 1863, sections 9, 10, and 12, telegraph companies were restrained from placing posts and wires along thoroughfares without the consent of the body having control of such thoroughfares. By the Act of 1868 the Act of 1863 was made to apply to the Postmaster-General. So this Act only restrained telegraph companies and the Postmaster-General; but in relation to other public bodies and to private individuals placing posts and wires along the public thoroughfares, the responsibility of seeing that they were placed properly, and did not cause danger to the public, rested with the body having the control of

the streets and highways. In the opinion of the Government nothing had arisen to render necessary a departmental inquiry with a view to avoid the risk to persons using the thoroughfares under the telegraph wires. If any wire were erected to which the local authority took exception on the score of danger to the public, they could restrain the Postmaster-General in the matter.

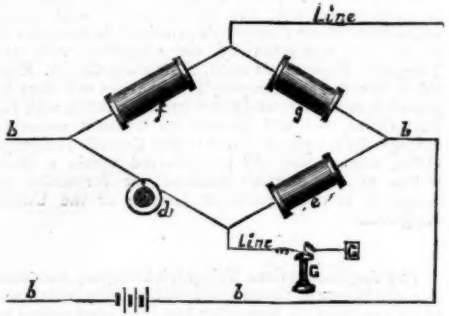
HER MAJESTY'S GOVERNMENT have appointed the Earl of Crawford and Balcarres Chief Commissioner, and Sir Charles T. Bright, Professor D. E. Hughes, F.R.S., and Lieutenant-Colonel C. E. Webber, R.E., as Commissioners, at the forthcoming Electrical Exhibition and Congress at Paris.

IN accordance with a resolution unanimously passed at a meeting of the British exhibitors at the Paris Electrical Exhibition, subscriptions towards a guarantee fund for the *decoration*, *maintenance*, and *service* of the British section were invited. A considerable sum has already been subscribed.

THE Weston Company has commenced an action against the Brush Lighting Companies in the United States for an alleged infringement of patent. The claim is for one of the most important features of the Brush system.

THE tramcar recently tried in Paris was driven by 160 Faure accumulators, the cost of the latter being £800, and weighing a ton and a quarter.

THE combination of Wheatstone bridge in a battery-circuit, with a transmitter placed in one of the arms of the bridge, and a main line which forms the cross-wire of the bridge, and a receiver placed in the main line,



which is shown by the figure, has recently been patented in the United States. (Patent No. 243,311, dated April 22nd, 1881.)

A SYSTEM of lighting and extinguishing gas lamps by pneumatic action is now under trial in Sheffield. The system is the invention of Mr. G. Weston.

A LARGE ELECTRO-MAGNET.—MM. Von Feilitzsch and W. Holtz have recently made, for the University of Greifowald, an electro-magnet of enormous dimensions. The price of a bar of iron made in one single piece would have been too expensive, whilst on the other hand, in a system formed of several pieces, poles become developed at the contacts. The electro-magnet was, therefore, constructed of 28 plates of iron, 7 millimetres thick, bent into a horseshoe shape, and of a size such that their combination forms a cylinder 195 millimetres in diameter. These plates are varnished, in order to avoid the formation of extra currents; they are connected together by iron bands, and so arranged as to form a cylinder of uniform diameter. The total height is 125 centimetres, the distance between the poles 596 millimetres; the total weight 628 kilogrammes. The magnetising helix is composed of 100 kilogrammes of plates of copper, forming 15 layers, insulated from one another by gutta percha. Outside there are 175 kilogrammes of wire, 2 millimetres thick, forming 5 double layers of wire, and the extremities of the different parts of the circuit communicate with terminals fixed on insulated columns, which allow of any required connections being made. The poles are topped with two plates, 33 millimetres thick, which can be set at any required distance apart, and are capable of carrying various accessories. A movable plate, placed between the two branches, can be placed at any convenient height for the experiments. With this apparatus, excited by 50 small Grove cells, it was possible to melt in two minutes 40 grammes of Wood's metal by Foucault's experiment, and if the poles were set close, the resistance stopped the movement in spite of the tension of the driving band. It is very easy to show the rotation of the plane of polarisation in heavy glass, when the latter is traversed by a ray of light, &c. In this apparatus, as has been pointed out, the bar of iron weighs 628 kilogrammes, and the wire 275 kilogrammes, whilst in the one constructed by Plücker, and which was the largest existing, the weights were only 84 and 35 kilogrammes respectively. —*Les Mondes.*

DR. OLIVER J. LODGE has been appointed to the Lyon-Jones Professorship of Experimental Physics and Mathematics by the Councils of University College, Liverpool, and of the Liverpool Royal Infirmary School of Medicine.

A PATENT for an electric cable (No. 242,894, dated May 9th, 1881), has recently been taken out in the United States by Mr. Patrick Delany. The cable, which is shown by the figure, consists of a lead tube flattened out, and containing insulated wires inserted

inside. In the manufacture the cable is passed between corrugated rollers, which press the lead close around the insulated wires. The lead tube is connected to the ground, and at junction the wires are crossed to avoid induction.

BELGIUM will take a considerable share in the forthcoming Paris Exhibition. The number of exhibitors is over a hundred. Among other exhibits the Jaspar regulator and the *lampe-soleil* of MM. Clerc and Bureau will compete prominently with the numerous other systems of electric lighting. Of telephone specialists M. de Locht-Labye will show his pan-telephone in action, and M. Navez's researches will doubtless

receive due attention. Meteorological instruments will be specially represented by those of M. Van Rysselberghe, with which the indications of a meteorograph at a distance are registered directly at Brussels Observatory. Colonel Leboulangé will exhibit ballistic apparatus of special type, and his ingenious dronometer and dromoscope for controlling the velocity of trains, especially at dangerous points. Various kinds of telegraph wire will be shown, and a special interest will attach to the wires of phosphor bronze from the works of M. Montefiore Lévy; these wires have a conductivity four times that of iron, and their tenacity being also much greater, lines may be made in which the wire section is greatly reduced. An official and special catalogue is being prepared for the Belgian section; it will comprise an introductory notice by M. Bonneux on electrical science and industry in that country.—*Nature.*

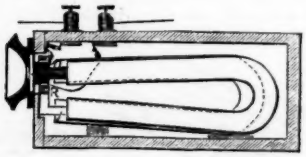
FROM experiments made by Herr Muraska, it appears that graphite conducts the best of any variety of carbon, whilst its resistance varies the greatest by variation of temperature. It is thus thermo-electrically negative to all known varieties of carbon.

THERE are now nearly 150 offices connected by telephones in Hamburg.

THE s.s. *Chateau Leoville*, built for a French company, and recently launched at Sunderland, is to be fitted with the Swan incandescent lamp.

THE French Minister of Postal Telegraphy recently sent to the several telegraphic offices forms for recording all the observations connected with thunderstorms. The forms have been drawn up by M. Mascart, the head of the Meteorological Office, and printed at its expense.

THE telephone shown by the figure has been patented (No. 242,816, dated Nov. 28th, 1877) in the United States by C. Cuttress and J. Redding, assignors to J. Wentworth Brown and H. Hyde. The arrangement



consists of a tympanum or plate rigidly supported at its edges, but free to vibrate at its centre, with a hollow cylindrical helix of insulated wire mounted axially upon the tympanum.

MR. EDISON has patented (No. 242,896, dated Dec. 15th, 1881) the incandescent lamp shown by the

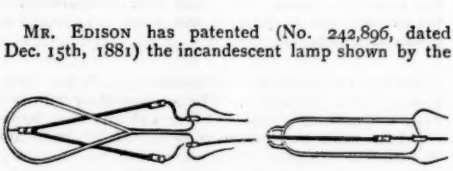


figure. The novelty of the arrangement lies in the combination, with the incandescing loop of an electric lamp, of a support arranged to maintain the carbon loop in its normal position.

THE time-ball recently erected at Kansas City, and which is dropped as a part of the time service of the Morrison Observatory, is the first attempt in this direction in the West. It was paid for chiefly by an appropriation of the City Council of that city. The site selected was the large building just erected by the Messrs. Bullene, Moores & Emory, on Delaware Street. The ball when raised to the top of the staff is about 140 feet above the street, and is generally visible to the business portion of the city. The ball, which passes over the staff, is simply a wire skeleton covered with canvas and painted black, and is about three feet in diameter. It was loaded on the inside with lead until it was found to drop instantly and without loss of time. It has a drop of about twenty-five feet and is slowed up as it reaches the bottom, and is received upon a set of tall springs surmounted by a stout cushion. The apparatus by means of which the ball is dropped at precisely the right instant was constructed under the direction of Mr. W. F. Gardner, the instrument maker of the Naval Observatory at Washington. It is of a very simple form, and is found to answer all requirements. This has been found to work easily and without loss of time, and can scarcely get out of order. The entire cost of mounting the ball and machinery was only about 120 dollars, and with this small amount it was necessary to use the utmost economy in the purchase of materials and apparatus. Kansas City is about one hundred miles from the Observatory, and except in cases of breaking of the wire, when the ball cannot be dropped at all, it is dropped within one or two-tenths of a second of correct time.—*Science.*

THE United Telephone Company has just concluded an arrangement with the Postmaster-General, under which three of the Company's principal Exchanges will be at once connected by the telephone with the Telegraph Department at St. Martin's-le-Grand. Each subscriber to the Company's Exchanges will thus be placed in immediate and direct communication with the Post Office, and will be able to transmit messages through the telephone direct to the Central Telegraph Office, whence they will be delivered within a short radius of St. Martin's-le-Grand, or forwarded by telegraph to other parts of London or the United Kingdom.

THE Anglo-American Telegraph Company announce that the Brest-St. Pierre cable laid in 1869, which was broken on the 12th November last, has been picked up in 1,700 fathoms of water and repaired. As a consequence, telegraphic communication between France and the United States of America by this Company's cable *via* Brest has been restored.

LA COMPAGNIE FRANÇAISE DU TÉLÉGRAPHE DE PARIS À NEW YORK.—Some very interesting statements respecting this company have recently been published in *Truth*. We would refer those of our readers who are desirous of obtaining them to the issues of that paper for June 23rd and 30th, and July 7th.

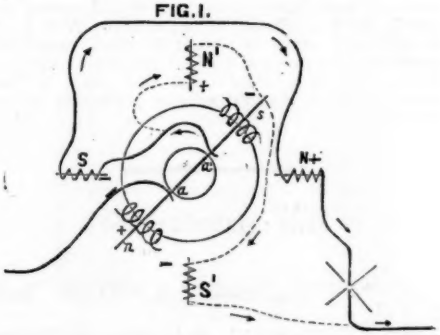
THE electric lights in Cheapside, says the *Daily News*, as far as Queen Street, St. Paul's Churchyard, Ludgate

Hill, Bridge Street, and Blackfriars Bridge—that portion of the City served by the Brush system—failed on Sunday night last, and recourse had to be made to the gas lamps.

THE United States Circuit Court, on June 27th, Judge Lowell, rendered a decree for the complainants in the suit of the American Bell Telephone Company *et al v.* Albert Spencer *et al*. This was a bill in equity alleging infringement of two patents granted to Alexander Graham Bell. The defendants admitted that they had infringed some valid claims of the second patent, but the plaintiffs have given them no evidence of such infringement. They rely entirely upon the fourth claim of the first patent, which is much more comprehensive in its scope. This claim was that the defendants are using a method and apparatus for transmitting vocal sounds which resemble those of the plaintiff in producing electrical undulations, copied from the vibrations of a diaphragm, and sending them along a wire to a similar receiver at the other end. The court decides that the specific method of producing the electrical undulations is different. It is made on the principle of the microphone, which has been very much improved since the date of the first Bell patent. The judge says:—"If the Bell patents were for a mere arrangement or combination of old devices to produce a somewhat better result in a known art, then, no doubt, a person who substituted a new element not known at the date of the patent might escape the charge of infringement. But Bell discovered a new art, that of transmitting speech by electricity, and has a right to hold the broadest claim for it which can be permitted in any case—not to the abstract right of sending sounds by telegraph without any regard to means, but to all means and processes which he has both invented and claimed."—*Operator*.

SCHUCKERT'S DIFFERENTIAL RING-LAMP.—This lamp, for which Sigmund Schuckert, of Nurnberg, has taken out a German patent (No. 13,619), is in principle an electro-magnetic machine, through which, while burning, two currents constantly pass, tending to

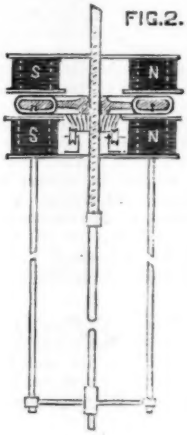
FIG. 1.



turn a rotatory inductor in opposite directions. One of these is the main current which passes through the luminous arc, whilst the other is introduced as a branch-current and does not traverse the arc. As is shown in diagram fig. 1, the current is introduced by the pencil at *a* into the ring-inductor, from which it issues again at a^1. Here it is divided, one branch (the main current) passing to the electro-magnets, S and N, and through the luminous arc back to the machine, the branch-current flowing through the electro-magnets, N^1 and S^1, and returning from here direct to the machine. The coils and the resistances of the branches, S, N, and S^1, N^1, are so arranged that for a given magnitude and a corresponding resistance of the luminous arc, the magnetic actions of both upon the inductor are in equilibrium. If the resistance of the luminous arc is modified, the resistance of the circuit of the main current is affected correspondingly, and according to the increase or decrease of this resistance the magnetic action of the by-current and of the main-current upon the ring-inductor predominates.

Schuckert carries out this principle in various constructions, one of which is shown in fig. 2. The induc-

FIG. 2.



tor, which here takes the form of a flat ring, carries a female screw, into which the upper carbon-holder, provided with a screw-thread, is introduced. As the ring, according to the ratio of resistance between the main current and the by-current, is affected by one or the other, the carbon-holder moves upwards and downwards, and thus the magnitude of the luminous arc is regulated, independently of the total strength of the current. This internal regulation of the lamp permits the introduction of several lamps in one common circuit.—*Electrotechnische Zeitschrift*.

THE *Standard* says:—"Numerous complaints reach us as to the frequently recurring inaccuracies in the Stock Exchange prices impressed upon the tapes of the Exchange Telegraph Company. The inconvenience caused to stockbrokers in consequence is considerable, clients at a distance constantly calling their attention to discrepancies between the tape figures and those at which business is actually transacted." This, we presume, means that the apparatus is defectively adjusted. We do not recollect having heard of any complaints before, although the system has been at work for several years.

THE arrival in the Thames of a steamer from the Clyde steered by electric apparatus has excited much

attention in scientific circles. The experiment was highly successful with one important exception, which does not appear to be generally known. The electric apparatus steered the ship, but it so eccentrically affected the compasses that they were of no use. We are not aware from what cause this peculiar effect arose, but there seems no reason to suppose that it cannot easily be overcome.

THE WESTERN AND BRAZILIAN TELEGRAPH COMPANY (Limited).—A supplementary report has been issued by the directors of this company with reference to the actions in progress for the recovery of large sums of money alleged to have been improperly expended in the promotion of the company. It would appear that, as has all along been expected, offers of compromise have been received. The directors say that "they have good reason to believe that a compromise of these actions, as against the great majority of the defendants, can be effected, whereby the company will receive a sum of £100,000 in cash and £110,000 nominal in shares, with liberty to the defendants to substitute for the latter the fixed sum of £8 per share, and reserving the rights of the company as against the remaining defendants, the company defraying its own expenses, and conceding to the liquidators of Hooper's Telegraph Works (Limited) one moiety of such portion of the assets of the Central American Telegraph Company (Limited) as may be agreed or determined to belong to this company in respect of their claim upon the Central Company. The directors are unanimously of opinion, having regard to all the circumstances, that it will, in the interests of the company, be expedient to make such a compromise."

THE Eastern Telegraphic Company notify the interruption of their Aden-Bombay cables near the shore at Bombay. Until they are restored telegrams for India, China, Australia, &c., should be sent by the lines of the Indo-European Telegraph Company.

AT the ensuing meeting of the India Rubber, Gutta Percha, and Telegraph Works Company (Limited), the directors will recommend the distribution of an interim dividend of 10s. per share, free of income tax, being at the rate of 10 per cent. per annum.

Correspondence.

CONTACT-TELEPHONE OR MICROPHONE TRANSMITTER.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—I notice on page 259 of the TELEGRAPHIC JOURNAL for the 1st inst. that M. Emile Berliner claims to have been the original inventor of the contact-telephone or microphone. I therefore venture to inform you that I made and had a transmitter (similar to that shown in the diagram accompanying the description of M. Emile Berliner's contact-telephone) in use experimentally as early as November, 1878. My transmitter was described in the *Somerset County Gazette* of November 19th, 1878, as follows:—

"The instrument consists of a diaphragm made of ferrotype plate fastened in a vertical position. In the centre of the diaphragm a piece of carbon is secured. The base of the carbon is against the back of the diaphragm, and its point rests lightly against another piece of carbon, which is fixed on the top of a brass spring. There is a screw in the rear of the spring for adjusting purposes. This simple instrument, when connected to a telephone and battery, will transmit articulate and other sounds very distinctly."

Yours obediently,
F. T. J. HAYNES.

Taunton.
July 4th, 1881.

P.S.—Can you kindly furnish me with the date of the first patent taken out for carbon transmitters?—F. T. J. H.

[Berliner's first patent was applied for on April 4th, 1877. For further information on the subject, we would refer you to the third note on page 406 of the TELEGRAPHIC JOURNAL for Dec. 1st, 1880.—ED. TEL. JOUR.]

IMPROVED ELECTRO-MOTIVE ENGINE.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—In answer to your correspondent, "Volt," regarding the motor I described at p. 229, it will be well to premise that the term one man-power is very indefinite and indeed unsatisfactory, since no one knows what a man-power is unless we assume it to approximate somewhat to the sixth-part of a horse-power—that is, 5,500 foot lbs. in a minute. This energy the motor described will not exert. Its limit of power is, probably, less than one-fifth of this—that is, 1,000 foot lbs., with three of my sustaining cells, as described. Since the resistance of both armature and field magnet is low, an electro-motive force of about six volts at the seat of generation of current suffices to give a great velocity to the armature, and this e. m. f. is obtainable by the use of three cells. As to their size, plates presenting an active surface of about 60 square inches—say plates, 6 by 5—will suffice. As a matter of course, if it be desirable to have at command a greater mechanical power than that mentioned, both engine and generator must be enlarged. As to the cells, I have been improving them, and can now, from cells of the same bulk as I before used, obtain a sustained current for double the time without any attention. With a cell or containing vessel as already described, capable of containing one gallon of liquid, I can obtain a constant current for six or eight hours at a time. I shall endeavour to offer constructional particulars of the new cell.

A.

New Patents—1881.

2823. "Secondary batteries." A. P. LAURIE. Dated June 28.

2826. "Electric fuses." D. JOHNSON and E. SPON. Dated June 28.

2833. "Improvements in electric incandescent lamps and in burners for same." G. G. ANDRÉ and E. EASTON. Dated June 28.

2846. "Apparatus for transmitting sounds by means of electricity." E. J. PATERSON. Dated June 29.

2848. "Treatment of carbon for electric lighting and other purposes." J. G. LORRAIN. Dated June 29.

2851. "Electric lighting apparatus." W. R. LAKE. (Communicated by J. J. Wood.) Dated June 29.

2867. "Telephonic apparatus." W. E. POTTER. Dated July 1.

2879. "Improvements in railway signalling and in apparatus for effecting the same by electricity." E. TYER. Dated July 1.

2930. "Electric lamps." E. P. WARD. Dated July 5.

2943. "Electro-magnetic motors." S. PITT. (Communicated by M. G. Farmer.) Complete. Dated July 5.

2944. "Manufacture of electric telegraph wire ropes or cables." J. P. HOOPER. Dated July 5.

2954. "Magneto or dynamo-electric machines or electric engines." P. JENSEN. (Communicated by T. A. Edison.) Dated July 6.

2986. "Telephonic signalling and commutating apparatus." J. IMRAY. (Communicated by C. Ader.) Dated July 7.

2988. "Improvements in telephonic apparatus, part of which improvements is also applicable to other electrical or magnetic apparatus." G. L. ANDERS. Dated July 7.

2989. "Apparatus for the transmission of power by electricity." J. HOPKINSON. Dated July 7.

2995. "Telephonic and telegraphic signalling apparatus." A. C. BROWN and H. A. C. SAUNDERS. Dated July 7.

3015. "Improvements in electric lighting apparatus, which invention comprises mechanism applicable for other purposes." W. R. LAKE. (Communicated by J. J. C. W. Greb.) Dated July 8.

3032. "Improvements in regulating electric currents, and in the apparatus or means employed therein." Sir W. THOMSON. Dated July 9.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1880.

4049. "Electric machines." A. W. L. REDDIE. (A communication from abroad by MM. A. Biloret and C. Mora, of Paris.) Dated Oct. 5. 6d. In this invention the induced current in a dynamo machine is passed round all the poles of the field magnets at once, and a current from each pole where the wire of that pole comes out can be utilised, so that there will be four distinct currents with the Gramme or Siemens machines, which have four poles, and two currents with the Lontin machine, which has but two poles. The invention also relates to an improvement by which greater solidity is imparted to the armatures of dynamo or magneto-electric machines. Fig. 1 represents a front view partly in section of a dynamo-electric machine. Fig. 2 is a plan view of the same, also partly in section. *b*, *b*, are the induction bobbins, the cores of which are mounted between the two

FIG.3.

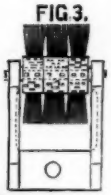


FIG.4

FIG.1.

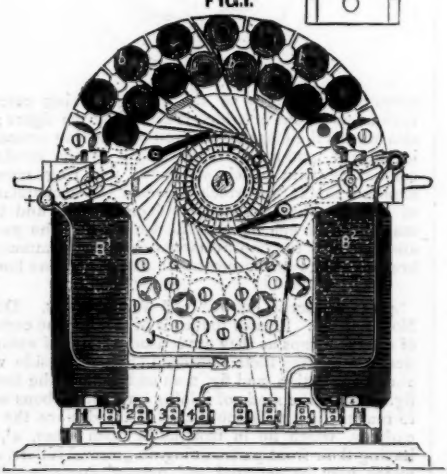
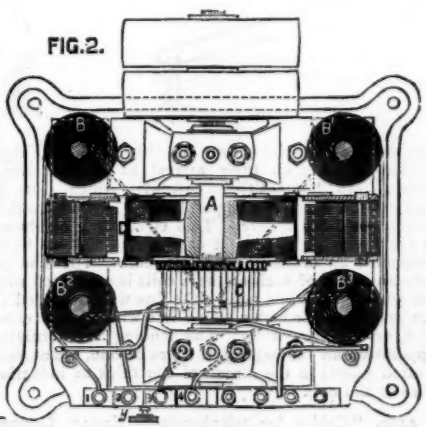
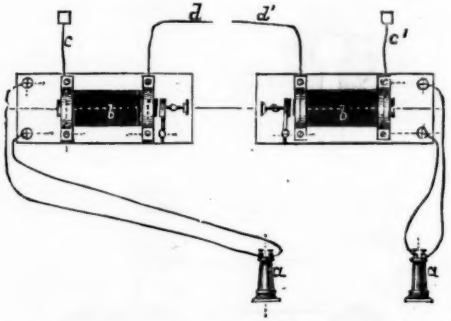


FIG.2.



cheeks or rings of iron, J, J^1, thus forming tie pieces, which give great strength to the armature, D, which armature is keyed to the axle, A, of the machine. B, B^1, B^2, B^3, are four bobbins constituting the field magnets, which are magnetised by means of the commutator, C, also keyed upon the axle, A. The inner ends of the wires coiled around these bobbins are grouped together at X, the outer ends being severally connected to the binding screws, 1, 2, 3, 4, fixed on insulated copper blocks. These copper blocks can be coupled together in pairs or otherwise by means of copper plugs, *y*, of which only one is shown in the drawing, as coupling the binding screws, 2 and 3. Thus the current will pass through two of the field magnets, and a stronger current is obtained than can be obtained from the binding screws, 1 and 4, each current in this latter case passing through one field magnet only.

4116. "Transmitting electrical currents through conductors," &c. W. R. LAKE. (A communication from abroad by Louis Maiche, of Paris.) Dated Oct. 9. 6d. Relates to an improved method of and means for transmitting and receiving electric currents, and is chiefly designed for facilitating the transmission and reception of telephonic or telegraphic messages or signals, whatever may be the kind or description of instrument employed as a sending or receiving apparatus. The invention consists essentially in transforming at the starting point "quantity" currents, of low tension (produced by the battery or other apparatus) into induced currents of high tension capable of overcoming the resistance of the line

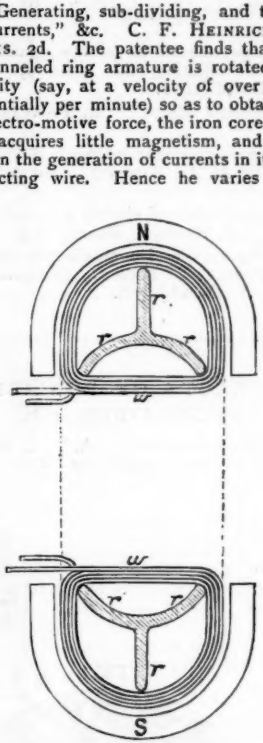


also in the transformation of these induced high tension currents on their arrival at the receiving station into "quantity" currents, which directly operate the receiving apparatus, or a relay which actuates a local battery. This is effected, as shown in the figure, by placing at each of the stations to be connected an ordinary induction coil. The fine or induction wire of each of these coils is connected with the wire of the other coil by the line wire arranged in the usual manner with a single line wire and an earth wire, or with two wires. The sending and receiving apparatus and the battery, if there be one, are at each station placed in the circuit of the thick or induction wire of the coil.

4482. "Cables for telephones." EDGAR GEORGE and JOSEPH BOND MORGAN. Dated Nov. 3. 6d. Relates to cables for overcoming telephonic induction. The wires are coated with an insulating substance in which wires are imbedded. The wires are connected to earth by conductors at intervals more or less distant as may be found necessary.

4581. "Telegraph receiving apparatus." JOHN WILLIAM FULLER. Dated November 8. 6d. Relates to the mirror galvanometer described on page 249 of the last number of this Journal.

4608. "Generating, sub-dividing, and transmitting electric currents," &c. C. F. HEINRICHS. Dated Nov. 9. 1s. 2d. The patentee finds that when his patent channeled ring armature is rotated at a very high velocity (say, at a velocity of over 10,000 feet circumferentially per minute) so as to obtain a current of high electro-motive force, the iron core of the ring armature acquires little magnetism, and thus takes little part in the generation of currents in its surrounding conducting wire. Hence he varies with great



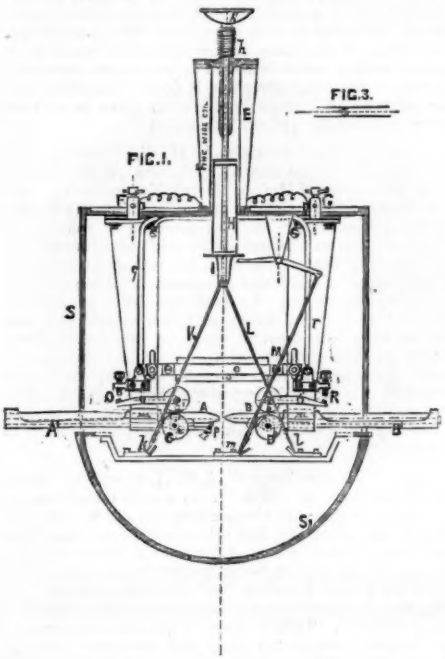
advantage the form of the channeled ring core in various ways, one of which is shown by the figure; by this means the mass of the iron of the ring armature is reduced, and a very large length of the insulated conducting wire which surrounds the ring core is exposed to the air, which prevents the accumulation of heat in the insulated conducting wire, and thus maintains the efficiency of the armature. The patent also relates to improvements in the commutator brushes and to improvements in circular carbon lamps.

4614. "Electric lamps." C. W. SIEMENS. Dated Nov. 10. 6d. Relates to means of feeding the carbons of electric lamps as they are consumed, and of automatically adjusting their distance. Fig. 1 is a side view partly in section, and fig. 2 an end view of the lamp; fig. 3 shows the mode of joining on fresh carbons so as to render the supply continuous. A and B are the two carbons, which lie in troughs or open tubes, A^1, B^1, having their front parts resting on grooved rollers, *a*, *b*, which may be serrated and pressed down by rollers, a^1, b^1, the weight of which may be aided by springs. On the axes of the grooved rollers, *a*, *b*, are broad wheels, C, D, which are finely serrated on their peripheries or may have their peripheries clothed with felt, soft leather, or other impressible material. E is a solenoid coil of high resistance which forms part of a

by-pass circuit connecting the conducting posts, F and G, for the main circuit of the lamp; H is the core of the solenoid, which is made as a thin iron tube for the sake of lightness, and is balanced or nearly so by a spring, h, adjustable by a screw cap, h^1. This cap is preferably made in the form of a cup, as shown, so that it can be more or less loaded by shot or other small heavy bodies. In the double stem, I, projecting down from the core, H, there are slots in which works a pin, i, jointing together two bars, K, L, which extend obliquely downwards, and rest by their lower ends in saddle pieces, k, l, in which position their inner faces are just clear of the peripheries of the wheels, C, D. These faces are at their lower parts serrated with ratchet teeth, as shown. Another bar, M, of like kind, resting at m, is jointed to an arm of a lever, N, the other arm

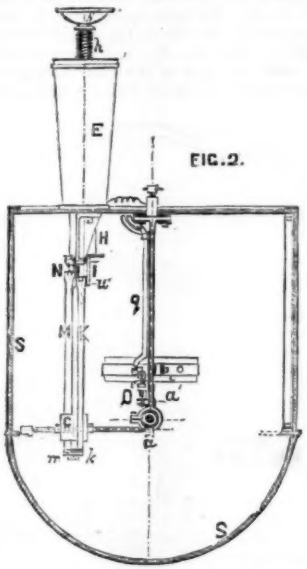
FIG.3.

FIG.1.



of which projects as a tappet under the core, H. Above the points of the carbons is fixed a reflector, O, which may be of marble or other refractory material clamped in a band, o. The operation of the lamp is as follows:—As the distance between the points of the carbons, A and B, increases by their consumption, the resistance to the direct circuit of the lamp increases, and consequently a larger amount of electricity passes through the by-pass circuit of the solenoid coil, E. The core, H, is thus attracted upwards, and by its ascent it draws up the two bars, K and L. These, as they retire from their rests at k and l, come to bear with their ratchet teeth against the wheels, C and D, and as they still ascend they cause these wheels to turn partly round in the direction of the arrows, thus turning the grooved rollers, a and b, and causing the carbons to approach one another. Should the carbons be too near, so that the resistance in the direct circuit of the lamp is small, then the solenoid, E, having little power, the core, H, descends, and when it has descended some distance it moves the tappet lever, N, raising the bar, M, which, acting on the wheel, D, causes it to turn partly round in a direction opposite to the arrow, and so to retract the carbon, B. The other carbon, A, is given an advancing movement, somewhat greater than that of B (which is effected by making the wheel, C, a little smaller in diameter than D, or by making the roller, a, a little larger in diameter than b), and is provided with a stop stud, P, which permits it to advance only as that portion of the carbon near its point against which the stop bears becomes consumed. Contacts, Q, R, are provided for the ends of the levers on which the rollers, a^1 and b^1, are mounted, these contacts being connected by wires, q, r, to the two insulated frames of the lamp. Thus, when either carbon is absent, the roller, a^1 or b^1 drops, and contact is made

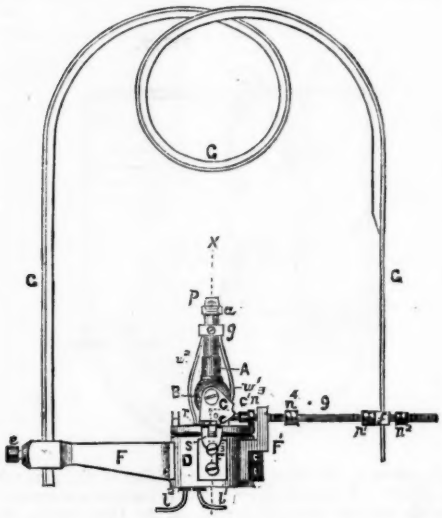
FIG.2.



at Q or at R, effecting a short circuiting of the general currents. As the carbons, A and B, become consumed, fresh carbons can be joined on to their ends, as indicated at fig. 3.

4626. "Apparatus for lighting and extinguishing gas by electricity." W. R. LAKE. (A communication from abroad by George D. Bancroft, of Boston, America.) Dated November 10. 6d. The figure is a front view of a burner and the apparatus which is attached to each burner in the circuit. A is a gas-burner, having the tip, a. B is the cock to which is screwed a sector or segmental arm, C, by which the said cock is turned. D is a cylindrical or round box, formed of iron, and having a hollow core, around which is wound a coil of wire, the box, coil, and core forming an electro-magnet. The core is screw-threaded at its upper end to receive the gas-burner, and at the lower end to screw upon the gas pipe is an armature hinged to a metal block which is screwed to the box, D. A spring, s, working in a pair of U shaped arms of a similar block, F^3, presses against a projection upon the armature, also lying between the said arms, and raises the armature, when the electro-magnet is demagnetised. G is a spring exposed to the heat of the gas-flame as shown, and secured at one end by a set screw, e, to a bracket, F, upon the

box, D, while its other end passes through a slot in the metal block, *f*, upon a rod, *g*, in which block it is kept from slipping by a tightening screw. This block, *f*, slides freely upon the rod, *g*, but its range of motion is limited by two nuts, n^1, n^2. The inner end of the rod, *g*, is attached to a crank-pin on the segmental arm, C, and the rod has a longitudinal motion in a slot, *t*, in the bracket, F^1, which motion is limited by nuts n^3, n^4, as shown. The segmental arm, C, has two shoulders, *c*, c^1, and the armature, H, has a projection, *r*, as shown. Behind the burner are two stiff, heavy wires, w^1, w^2, as shown, the former connected with one end of the coil of the electro-magnet, and the latter with the line wire, l^2. These wires, w^1 and w^2, are properly insulated, and pass through suitable bushings in the armature, H, and the wire, w^2, passes through the box, D. Above the said armature they pass through a block, *g*, secured to the burner, and end in two small binding screws, m^1, m^2, which are connected by a platinum wire, *p*, near the tip, *a*. The line wire, l^1, is connected with the coil of the electro-magnet. It is also connected with a suitable battery, and a make-and-



break circuit key at the operating station. The spring, G, is formed of two kinds of metal, brass and steel, the steel being the long thin strip shown, and the brass the stouter short strip. In its normal condition this spring exerts its force inward towards the burner, but when subjected to heat the expansion of the metal causes it to press outwards away from the burner. In the normal condition of the apparatus the shoulder, *c*, of the segmental arm, C, is caught upon the projection, *r*, of the armature, H. The operation of the apparatus is as follows:—To light the gas the operator sends a current over the line wire, l^1. The electro-magnet, overcoming the force of the spring, pulls down the armature and releases the shoulder, *c*, from the projection, *r*; the spring, G, being at the temperature of the atmosphere, forces inward the segmental arm, C, thereby opening the cock. At the same time, the current passing through the platinum wire, *p*, so heats the same that it ignites the escaping gas; when the operator then breaks his circuit at his distant station the projection, *r*, flies up against the shoulder, c^1. After the gas has continued to burn a few minutes, the thermo-spring, G, will become so heated by the gas flame as to exert its force in the opposite direction, and a single impulse of the electric current then sent over the line will release the shoulder, c^1, and close the cock.

4628. "Step-by-step type printing telegraphs." F. H. W. HIGGINS. Dated November 10. 6d. Has for its object improvements in step-by-step type printing telegraphs. The improvements relate to an arrangement of the mechanism of type printing instruments, which causes the printing to be done on a broad sheet of paper in lines like a newspaper, instead of as formerly in a single line on a continuous narrow band.

4674. "Telegraph cables." ROBINSON KENDAL. Dated November 13. 2d. Has for its object improvements in telegraph cables. A ribbon of sheet zinc is wound helically around the cable to be protected, so as entirely to inclose it, as it were, in an open jointed tube. One ribbon of sheet zinc having been thus wound on, a second similar ribbon is wound in the reverse direction, so that in the result the cable is double sheathed, and the twists being in opposite direction there is no tendency to unwind. (*Provisional only.*)

4739. "Electric batteries." H. E. NEWTON. (A communication from abroad by Lucien Alfred Wilhelmine Desruelles, of Paris.) Dated November 17. 4d. The carbon and zinc plates are inclosed in some fibrous or spongy substance, such as asbestos or spun glass, which will not be affected by the acids used for exciting the battery, but which will, by reason of capillary attraction or by molecular adherence, hold the exciting liquid in suspension. To facilitate the application of the invention to all kinds of batteries the saturated fibrous substance may be made up into small cakes, which are then compressed to get rid of any excess of acid; the cakes are then covered with a thin coating of dextrine, which in drying gives them great solidity. When it is desired to use such a cake it is only necessary to moisten it with pure water, and place it in the battery.

4745. "Electric lamps." J. E. H. GORDON. Dated November 17. 2d. Has for its object improvements in electric lamps. In electric lamps in which a precious metal, and especially the metal iridium, is employed, and being intensely heated becomes a source of light, an appreciable loss of metal is after a time experienced from the parts exposed to the high temperature. The object of the invention is to recover the metal which is so dissipated. This is done by causing a current of air to pass through the lamp, and afterwards through a flue or channel in which a large surface of an inert material is exposed. (*Provisional only.*)

4779. "Electro-magnetic apparatus for table services, offices, and warehouses." FLORENTIN HARMANT. Dated Nov. 19. 4d. This invention refers to a line of rails and carriages actuated solely by electricity or in conjunction with mechanical aid, such, for example, as a chain, metal rope, rack, or screw, but where electricity plays the principal part.

4825. "Dynamo-electric motors." CARL KESSELER. (A communication from Ernst Kuhlo, of Stettin.) Dated November 22. 4d. The object of this invention is to continuously cause the attraction of an electro-magnet to act upon a conductor or transmitter of power without interrupting the current, and thereby preventing a cessation of the power for a single moment. (*Provisional only.*)

4862. "Telephones." SYDNEY PITT. (A communication from abroad by Charles de Nottbeck, of St. Petersburg.) Dated Nov. 23. 2d. Has for its object

improvements in telephones. The mouth-piece of the transmitting telephone is closed by pasting or cementing over it a diaphragm of paper or like material. Also the bobbin is attached to the vibrating plate of the receiving telephone in place of to the magnet, as is usual. (*Provisional only*).

4886. "Dynamo-electric machines." JOHN HOPKINSON and ALEXANDER MUIRHEAD. Dated Nov. 24. 8d. Has for its object improvements in dynamo-electric machines and lamps for electric lighting. Figures 1 and 2 show a convenient method by which, according to the invention, the sparks which occur between the commutator and the collecting brushes in continuous current machines are reduced; *a*, *a*, *a*, are the segments of the commutators insulated from each other; b^1, *b*, *b*, are the collecting brushes or their equivalents carried on a spindle, *c*; one of these brushes, b^1, is arranged in such wise that there is an electrical resistance between the brush, b^1, and the spindle, *c*. *d*, *e* are metal cylinders; to *d* the brush is attached, whilst *e* is in contact with the spindle, *c*. The space, *f*, between *d* and *e* is filled with a mixture of plumbago and lamp black, having a suitable resistance; the ends of the space, *f*, are closed with discs of ivory. The brush, b^1, is so adjusted by bending or otherwise that it remains in contact with any segment of the commutator for a short space after the other brushes have left contact with that segment. The effect is, that instead of sudden rupture of continuity of the armature circuit connected to the segment of the commutator, a resistance is first introduced, and contact is not broken till the current has been in some measure reduced. For the more convenient adjustment of the machine several sets of brushes are provided having different resistances; it is ascertained by trial and use which gives the best result. Figs. 3 and 4 show the armature used in machines arranged so that the coils lie in planes parallel or nearly parallel with the plane of revolution of the armature. *a* is a pulley to be keyed on the shaft of the machine; it is surrounded by a series of layers, *b*, of sheet iron, more or less insulated from each other. In one or both faces of this ring of layers of iron radial slots are cut for the reception of the coils of insulated wire, *c*. On the pulley is coiled a band of sheet iron and of asbestos paper, so that the asbestos paper separates the successive layers of iron from each other. When a sufficient thickness has been obtained radial holes are drilled, and bolts, *d*, are inserted and secured by the cottars, *e*; the slots are then cut. The figures show the armature as arranged for a continuous current, that is, with the slots on one side halfway between the slots on the other side of the armature. This is done in order that the current may be more approximately continuous; but when an alternating current is desired, the slots in the opposite faces correspond.

FIG. 4.

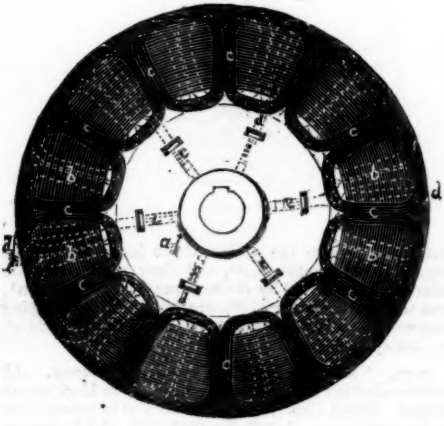


FIG 3

FIG. 2

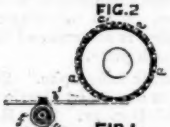


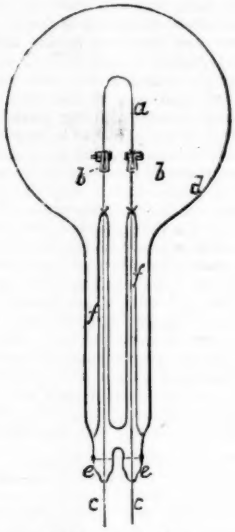
FIG 1

4914. "Electric light apparatus." W. L. WISE. (A communication from abroad by Jacques Ambroise Mandon, of Paris.) Dated Nov. 25. 8d. Has for its object improvements in electro-light apparatus, and relates particularly to a novel method whereby two pencils or carbons are kept with their upper extremities or poles in proper relative positions, notwithstanding the consumption, wasting, or wear due to the action of the electric current producing the light. To this end in one arrangement, wherein each carbon is formed as an arc of a circle, each carbon or pencil is carried or supported and balanced by apparatus arranged so that in proportion as the carbon or pencil is consumed or reduced by the action of the electric current, the carbon or pencil will automatically move upward in a circular path about a centre, coincident with that of the circle whereof the carbon or pencil represents an arc.

4933. "Electric lamps." J. W. SWAN. Dated Nov. 27. 6d. Relates to incandescent lamps. The carbon conductor is formed from cotton thread which has been subjected to the action of sulphuric acid of such a strength as to cause a change or conversion to take place in the thread of a similar character to that which is produced by the treatment of bibulous paper with sulphuric acid, according to the well-known process of making vegetable parchment. The cotton thread after being immersed in this solution and allowed to remain therein for a sufficient time to effect the required conversion, is removed from the solution and washed with water until the whole of the acid is eliminated, after which it is dried and carbonised by any of the suitable well-known means. The description of cotton thread most suitable for treatment in the manner described is that known as crotchet thread. The figure shows how the carbon filament is secured to the holders. *a* is the carbon formed of the prepared cotton thread, which is bent round and gripped at its two extremities by clips, *b*, to which the upper ends of the metal conductors, *c*, are attached; the carbons thus arranged, together with a convenient length of the metal conductors, *c*, are surrounded by a glass bulb or receptacle, *d*, and the lower ends of the metal conductors which pass through the bottom of the glass receptacle, *d*, are sealed into the same, but when metal

conductors of large sectional area are employed, it is preferred to secure their lower ends to platinum caps,

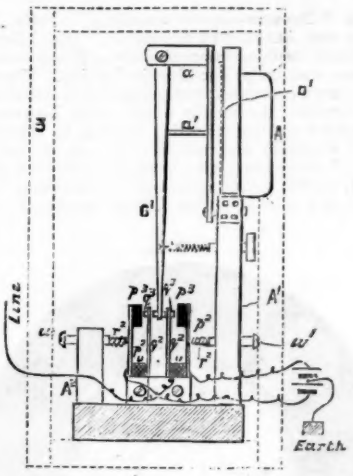
FIG. 1.



e, which are attached to the bottom of the glass receptacle, *d*, by fusing the glass around the caps.

4961. "Mechanical contrivances for electro-magnetic clocks," &c. JOHANN MAYR. Dated Nov. 29. 2d. Consists in mechanical improvements, by means of which it is possible to construct a new system of electric clocks and improved signalling apparatus, and to replace the usual sliding spring and mercury contact by reliable metallic contacts with impact motion and exactly controllable duration. (*Provisional only.*)

4981. "Telephonic apparatus. W. R. LAKE. (A communication from abroad by Charles Adams Randall, of New York.) Dated Nov. 30. 1s. This invention consists mainly of a telephone system, in which, by means of a variable contact pole changing circuit-closer, operated by a diaphragm under the influence of sound vibrations, electrical connection with a line wire is alternately made and broken from opposite poles of a battery or batteries, the makes and breaks of the circuit being attended by varying pressure between the contact points of the circuit-closer, and battery currents or impulses of alternately opposite polarities and varying force are caused to pass over the line circuit in correspondence to sound vibrations. In the fig. A is a mouth-piece, containing a diaphragm, supported by a standard, A^1, and from the upper portion of the said mouth-piece case projects an arm, *a*, to which is pivoted the upper end of a lever, G^1, from which projects an arm, a^1, in contact with the diaphragm at D^1. The lower end of this lever is preferably provided with insulating studs (if the lever is metal). In each of the line and battery contact devices a rock shaft, *u*, journalled in suitable bearings, has fixed thereto a block, *v*, of hard india-rubber or other insulating material, and from this block project upward the plates, p^2, and springs, q^2, which respectively carry the carbon buttons, p^3, and platinum studs, q^3. Springs r^2, r^3, press against the plates, p^2, and have their tension controlled by screws, w^1, w, passing through the standards, A^1 and A^2. The connections between the line wire and the battery are made in the manner shown. By means of the screws, w, w^1, it is obvious that the amount of pressure between the platinum studs, q^3, and carbon



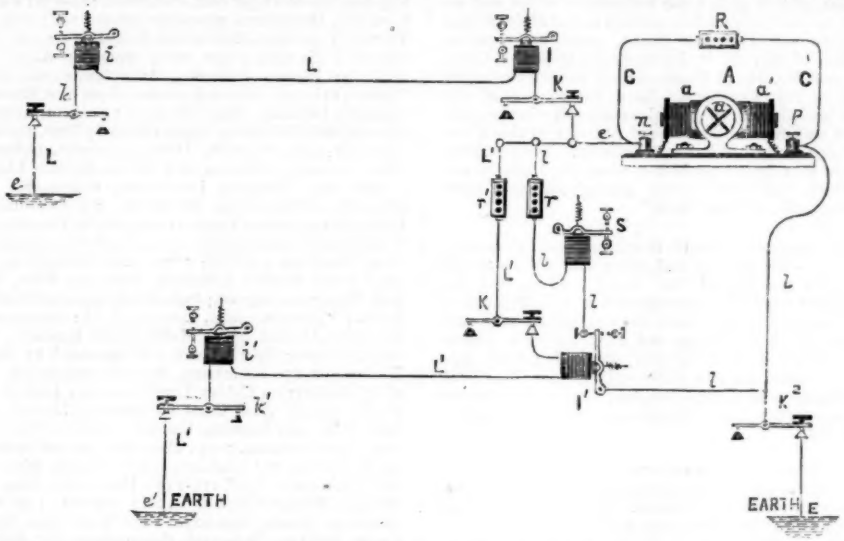
buttons, p^3, under the action of the lever, G^1, may be regulated, as the plates, p^2, and their rock shafts are alternately oscillated by the movement of the lever, G^1, and the carbon buttons, p^3, are brought into varying degrees of contact pressure with the platinum studs, q^3, on the springs, q^2.

5033. "Electric lamps." J. H. JOHNSON. (A communication from abroad by Auguste de Meritens, of Paris.) Dated Dec. 3. 2d. Relates to improvements in the production of light by electricity, and it consists in the employment of iron rendered incandescent by the passage of an electric current of high tension. (*Provisional only.*)

5068. "Telephonic and electric communication," &c. J. N. CULBERTSON and J. W. BROWN. Dated Dec. 6. 6d. Has for its object improvements relating to telephonic intercommunication, so as to get rid of telephonic induction. With this object the switch board at the central office is so arranged that each wire has an independent earth plate.

5352. "Dynamo-electric telegraphy." SYDNEY PITT. (A communication from abroad by Orazio Lugo, M.D., of New York.) Dated Dec. 21. 8d. Relates to the application of dynamo-electricity for the transmission of telegraphic signals. The arrangement of the apparatus is shown by the figure. A represents the dynamo-electric generator, having its armature coils, *a*, and field magnets, a^1, a^1, connected together in the same circuit. The exterior or working circuit consists of the wire, *l*, which connects the positive pole, *p*, of the generator, A, with the earth at E (and which together with the earth itself forms a conductor of no appreciable resistance), the wire, 6, also of no appreciable resistance, and three telegraphic circuits, L, L^1, and *l*, which branch from the wire, 6, at the negative pole of said generator, and terminate the first two in the earth at *e* and e^1 respectively, and the third in the wire, *l*, at the positive pole. The telegraph lines, L and L^1, are each provided with transmitting keys, K, *k*, K^1,

k^1, for alternately breaking and closing the circuit in order to transmit intelligible signals, and also with suitable receiving instruments, 1, i, and 1^1, i^1, these being placed at different stations, as shown. The line,



l, l, represents a local circuit of small resistance, which is employed to actuate a sounder or other like instrument, s, through the intervention of the instrument, 1^1, which is shown as a relay. The shunt circuit, c, c, connects the positive and negative poles, p and n, of the generator, A, and it, in effect, forms a branch of the exterior circuit. In order to maintain the proper relation between the resistances of different portions of the systems, the resistance of the shunt circuit is made adjustable. Resistances, r, r^1, are inserted in the shorter lines, so as to bring each of the resistances of the latter to a level.

City Notes.

Old Broad Street, July 13th, 1881.

THE EASTERN TELEGRAPH COMPANY, LIMITED.—The report of the directors for the six months ended 31st March, 1881, states that the Company's revenue for this period amounted to £302,158 18s. 3d., from which is deducted £67,754 0s. 7d. for the ordinary expenses of the Company, and £29,942 1s. 2d. expenditure on repairs of cables during the half-year, and £3,276 5s. 6d. for income tax, leaving £201,186 11s. 0d., which, together with £28,430 8s. 1d. brought forward from the preceding half-year, gives a balance of £229,616 19s. 1d. From this balance £22,629 15s. 0d. has been paid for interest on debentures, and £20,473 17s. 6d. for dividend to 31st March, 1881, on the preference shares, and £70,000 has been placed to the General Reserve Fund. This sum, with £18,771 13s. 9d. received during the half-year for interest and profit on sale of investments, brings up that fund to £356,608 13s. 6d., and with the special reserves mentioned in the balance-sheet makes the total amount of the reserves £392,060 12s. 3d. The directors have, during the half-year, paid an interim quarterly dividend of 1¼ per cent. on the ordinary shares. They now recommend the declaration of a final dividend for the year ended 31st March, 1881, of 2s. 6d. per share and a bonus of 1s. per share, both payable on the 15th inst., making, with the three previous payments on account, a total dividend for the year of 5¼ per cent. on the ordinary shares, and that the balance £2,723 6s. 7d., be carried forward to the next account All the Company's cables are in good working order with the exception of one of the cables between Aden and Bombay, which was recently interrupted in shallow water close to the Bombay shore, and will be speedily restored. Reference was made in the last report to the direct Lisbon cable broken off the coast of Portugal, in 2,000 fathoms of water. The restoration of the line was completed by the s.s. *Chiltern* in May last. The s.s. *Chiltern* has also been engaged in laying a cable from Sicily to the Island of Lipari, a distance of 23 miles, and a new 3-conductor cable across the Straits of Messina. These lines have been laid under agreements with the Italian Government, in consideration of the payment by the Government of subsidies amounting to £1,050 per annum for 30 years. The cost will be charged to revenue account. The revenue includes £19,500 dividend and bonus for the half year upon the Company's shares in the Eastern and South African Telegraph Company, the dividend being at the rate of 6 per cent. per annum, with a bonus at the rate of 4 per cent. per annum. £30,000 has been placed to reserve, and £2,114 1s. 1d. carried forward. The Eastern and South African Company have paid over £16,683 6s. 8d. to the trustees of the Sinking Fund for redemption of the debentures. The total amount of the Company's reserves is now £59,014 15s. 5d. The revenue account also includes £2,600 dividend for the half-year on the shares of the Black Sea Telegraph Company belonging to this Company, by whom the line is worked and maintained under agreement.

ANGLO-AMERICAN TELEGRAPH COMPANY, LIMITED.—Mr. H. Weaver, the managing director of this Company, informs us "that the Brest-St. Pierre cable laid in 1869, which was broken on the 12th November last, has been picked up in 1,700 fathoms of water and repaired by the Telegraph Construction and Maintenance Company with their s.s. *Scotia*, under the superintendence of Mr. F. R. Lucas, engineer to that Company, and Mr. H. C. Forde, acting as engineer upon behalf of this Company. As a consequence of the repair just effected, telegraphic communication between France and the United States of America by this Company's cable *via* Brest has been restored. The Company has now four Atlantic cables at work, *via* Valentia and *via* Brest, and their system throughout is in good working order and condition."

THE DIRECT UNITED STATES CABLE COMPANY, LIMITED.—We are informed under date the 8th of July that at a meeting of the board held on that day it has been resolved to recommend a final dividend of five shillings (5s.) per share (free of income tax), such dividend to be payable on and after the 16th August next, making with the interim dividends already paid five per cent. for the year ending 30th June last, carrying forward £7,179 10s. 8d., after having carried to the reserve fund £32,292 9s., making it up to £235,000.

THE AMERICAN TELEGRAPH AND CABLE COMPANY.—The final splice in this Company's cable was made at 10.20 p.m. on the 8th instant. The cable is in every respect said to be a first-class one.

THE CUBA SUBMARINE TELEGRAPH COMPANY, LIMITED.—The balance-sheet and accounts for the half-year ended 30th June last state that the gross receipts, including the balance brought from last account, amount to £18,503 9s. 1d., and the gross expenditure to £5,714 6s. 2d., leaving a sum of £12,789 2s. 11d. to the credit of revenue account. Of this, the sum of £3,750 11s. 9d. has been placed to the reserve fund, increasing that fund to £40,000. After providing for the preference dividend, a balance of £6,038 11s. 2d. remains, out of which the directors recommend the payment of a dividend on the ordinary shares at the rate of 7 per cent. per annum, the same rate as was paid for the corresponding period of last year, free of income tax, which will absorb £5,600, and leave £438 11s. 2d. to be carried forward to the current half-year's account. The directors have much pleasure in reporting that the new cable contracted for with Messrs. Hooper's Company to replace the original one was laid from Cienfuegos to Santiago de Cuba by the s.s. *Hooper* in February last in perfect working order and excellent electrical condition, and has continued to work most satisfactorily. The shareholders will also be pleased to learn that the Company's other cables continue in good working order. The suit instituted against the Spanish Government at Havana for a return of the tax (about £1,000) erroneously levied on the Havana-Santiago business has been decided by the Court there in favour of the Company, but the decision having been appealed against to Madrid, it will be several months before a final settlement of the case can be looked for.

The following are the final quotations of stocks and shares for the 13th inst.:—Anglo-American, Limited, 53¼-53¾; Ditto, Preferred, 85-86; Ditto, Deferred, 25-26; Black Sea, Limited, ——; Brazilian Submarine, Limited, 10½-10⅝; Brush Light, 3½ pm.; Electric Light, ¼-½ pm.; Consolidated Telephone Construction, 1/16-3/16 pm.; Cuba, Limited, 9¼-9⅝; Cuba, Limited, 10 per cent. Preference, 16½-17¼; Direct Spanish, Limited, 4½-5; Direct Spanish, 10 per cent. Preference, 13½-14½; Direct United States Cable, Limited, 1877, 10¾-11⅛; Debentures, 1884, 102-104; Eastern Limited, 10½-10⅝; Eastern 6 per cent. Preference, 12⅞-13⅛; Eastern, 6 per cent. Debentures, repayable October, 1883, 103-106; Eastern 5 per cent. Debentures, repayable August, 1887, 104-107; Eastern, 5 per cent., repayable Aug., 1899, 106-109; Eastern Extension, Australasian and China, Limited, 11⅛-11⅜; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 109-112; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 103-106; Ditto, registered, repayable 1900, 103-106; Ditto, 5 per cent. Debenture, 1890, 103-105; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 103-106; Ditto, ditto, to bearer, 103-106; German Union Telegraph and Trust, 11-11½; Globe Telegraph and Trust, Limited, 6⅜-6⅝; Globe, 6 per cent. Preference, 12½-12⅞; Great Northern, 13¼-13¾; 5 per cent. Debentures, 102-105; India Rubber Company, 20½-21½; Ditto, 6 per cent. Debenture, 104-108; Indo-European, Limited, 28-29; London Platino-Brazilian, Limited, 5⅛-6⅛; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 8½-9¼; Oriental Telephone, ⅜-½; Reuter's Limited, 12-13; Submarine, 285-295; Submarine Scrip, 2¾-3; Submarine Cables Trust, 100-104; United Telephone, 9¼-9⅜; West Coast of America, Limited, 4½-5; West India and Panama, Limited, 1⅞-2⅛; Ditto, 6 per cent. First Preference, 7-7½; Ditto, ditto, Second Preference, 6½-7; Western and Brazilian, Limited, 8⅛-8⅜; Ditto, 6 per cent. Debentures "A," 110-115; Ditto, ditto, ditto, "B," 98-102; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 101-105; Ditto, 6 per cent. Sterling Bonds, 106-110; Telegraph Construction and Maintenance, Limited, 32¼-32⅝; Ditto, 6 per cent. Bonds, 103-107; Ditto, Second Bonus Trust Certificates, 3⅛-4⅛.

TRAFFIC RECEIPTS.

NAME OF COMPANY.		MAY.	JUNE.	REMARKS.
		£	£	
Anglo-American...	1881	49,880	48,240	
	1880	*41,970*	*19,560*	
Brazilian S'marine	1881	13,607	12,272	
	1880	*10,331*	*10,524*	
Cie. Française ...	1881	...	...	Not published.
	1880	..	..	
Cuba Submarine...	1881	3,000	2,757	
	1880	*2,972*	*3,147*	
Direct Spanish ...	1881	1,547	1,456	
	1880	*1,334*	*1,477*	
Direct U. States ...	1881	13,990	16,080	At 2s. per word
	1880	*16,650*	*6,680*	" 1s. 6d. "
Eastern	1881	43,872	40,074	
	1880	*42,963*	*42,522*	
Eastern Extension	1881	29,523	29,339	
	1880	*26,570*	*29,100*	
Great Northern ...	1881	21,600	21,760	
	1880	*19,480*	*22,520*	
Indo-European ...	1881	...	...	Not published.
	1880	..	..	
Submarine	1881	...	...	Publication temporarily suspended.
	1880	..	..	
W. Coast America	1881	...	...	
	1880	..	..	
West. & Brazilian	1881	9,249	3,943	
	1880	*7,797*	*3,725*	
West India	1881	5,560	4,743	
	1880	*3,775*	*3,597*	